Zero Retries issue 0036 2022-03-04

Advanced Amateur Radio - Data Communications; Space; Microwave… the fun stuff! The Universal Purpose of Ham Radio is to have fun messing around with radios - Bob Witte K0NR. Ultimately, amateur radio must prove that it is useful for society - Dr. Karl Meinzer DJ4ZC. We are confronted by insurmountable opportunities! - Pogo. Nothing great has ever been accomplished without irrational exuberance - Tom Evslin. Irrational exuberance is pretty much the business model of Zero Retries Newsletter - Steve Stroh N8GNJ.

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor

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As I discussed in Zero Retries 0035 just a few hours ago, I'm just not mentally up to writing about the use of radio technology in Russia's war against Ukraine. But I did hint that I would publish something about communications in Russia's war on Ukraine "soon" using Substack's "Threads1" feature but this "something" quickly grew beyond what Threads was intended for. Thus, this special edition of Zero Retries.

If you're thinking Starlink isn't Amateur Radio, you're right. But this story deserves to be more widely known, including within Amateur Radio. Starlink is *21st* century telecommunications infrastructure - *mobile, wireless, software defined, and rapidly iterated*.

Credit where due, YouTuber Steven Mark Ryan of Solving the Money Problem (one of my usual relaxations during my lunch break) tipped me off to this story. Ryan probably tells the story better than I'll be able to in text. Skip ahead to 1:42.

It has been widely reported that a shipment of Starlink terminals were delivered to Ukraine, and that SpaceX rapidly configured its Starlink constellation to accommodate those new terminals. The assumption is that the ground terminals to provide Starlink service to Ukraine are (safely) outside Ukraine's borders… probably protected behind NATO defenses in Poland.

What has been done since that delivery by the Starlink team to support emergency wartime use of Starlink in Ukraine is, in my opinion, *remarkable*.

At minimum, SpaceX *got the Starlink terminals to Ukraine,* in time for them to be useful - no small feat.

What happened next is told in a series of tweets. In sequence:

@FedorovMykhailo is Vice Prime Minister of Ukraine and Minister of Digital Transformation of Ukraine.

@FedorovMykhailo: many thx! Starlink keeps our cities connected and emergency services saving lives!
With Russian attacks on our infra, we need generators to keep Starlinks & life-saving services online - ideas?

@elonmusk: Updating software to reduce peak power consumption, so Starlink can be powered from car cigarette lighter.
Mobile roaming enabled, so phased array antenna can maintain signal while on moving vehicle.

Software update to adapt a civilian system for wartime usage so that it can be powered from 12 volts DC (presumably via a small 12 volt DC to 220 VAC inverter).

Then to enable mobile usage from a flat panel antenna, with beam forming. That's an experimental, or beta (to be generous) feature.

From a civilian organization. Wow.

@elonmusk: Important warning: Starlink is the only non-Russian communications system still working in some parts of Ukraine, so probability of being targeted is high. Please use with caution.

*When asked **how** to use with caution:*

@elonmusk: Turn on Starlink only when needed and place antenna away as far away from people as possible.

@elonmusk: Place light camouflage over antenna to avoid visual detection

When asked about painting the Starlink dish:

@elonmusk: Yes, provided no metal particles in paint.

What's remarkable about these last two exchanges is they're rapid replies, with actionable information. No waffling, no weasel-wording, etc. Just helpful answers, fast!

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We're in a way different world than I grew up in when the CEO of a (defacto) telecommunications company can be in direct communications, in a public forum, with a senior official of a country being attacked by Russia, in close to realtime.

I can't offer enough kudos for quick-acting SpaceX and SpaceX CEO Elon Musk for this work to very, very substantively aid the people of Ukraine. SpaceX, and Starlink really is an "only in the USA" success story. There just isn't any comparison. Musk might be a "challenging personality" at times, but we in the US can proudly point to him that he's *our* "challenging personality". There's no denying Musk's brilliance and drive and the "*Get it **DONE***" culture he has imbued into SpaceX and Starlink.

de Steve N8GNJ

Update 2022-03-06 - Overcoming Starlink Jamming

This update continues the "remarkable" theme of the performance of Elon Musk and Starlink and SpaceX in adapting the use of the Starlink satellite broadband communications system *in realtime* to the rapidly changing wartime situation to provide Broadband Internet Access in Ukraine against Russia's invasion.

First, in my original story, I missed mentioning this important response from Musk to a question about his "warning" tweet when he was asked if Starlink could be cyberattacked:

@elonmusk: Almost all Viasat Ukraine user terminals were rendered permanently unusable by a Russian cyberattack on day of invasion, so … yes

A few days after that exchange…

@elonmusk: SpaceX reprioritized to cyber defense & overcoming signal jamming.
Will cause slight delays in Starship & Starlink V2.

@elonmusk: Some Starlink terminals near conflict areas were being jammed for several hours at a time. Our latest software update bypasses the jamming.
Am curious to see what's next!

…

Let's parse this a bit, as Musk packs a lot of info into few words (mastery of Twitter as a medium).

> Will cause slight delays in Starship and Starlink V2.

To me, that statement implies that the work to improve Starlink's "anti-jamming" capabilities is pulling in resources not just from development of the next generation of Starlink satellites and ground systems, but also SpaceX as a whole. **It's just (sorry to overuse this word) *remarkable* to watch a company pivot *all* of its resources in realtime to deal with the jamming issue.**

And, it's not just that SpaceX as a corporation is pivoting its resources to meet this issue. What's *most* remarkable to me is that SpaceX *was smart enough to engineer this capability into the entire Starlink system from the beginning*. As I said at the beginning of this article, Starlink is *21st* century telecommunications infrastructure - *mobile, wireless, software defined, and rapidly iterated*. To those adjectives, I now add *robust*!

If you think that Starlink's capability for remote updates is "no big deal" because most Broadband Internet Access system support remote software updates (like my Comcast cable modem which goes offline most early mornings an hour or so), refer again to what happened to the Viasat terminals. Not only were they cyberattacked and rendered inoperable, it's that they were rendered *permanently* inoperable.

For that to happen isn't much of a stretch; if you know what you're doing (and in cyberwar, Russia *knows* what it's doing), it's not hard to emulate an authorized remote software update that wipes the "fallback" set of software in the device, or perhaps starting a routine that rapidly writes the flash memory so many times that it simply wears out. Thus no amount of resetting or "plug in a USB flash drive with new software" will work. The only way to restore that ground terminal to usable is to completely replace the modem.

Lastly, to a question and point made by a friend… that Starlink's capabilities and adaptability, especially as it is subjected to cyberattacks and jamming "might" be of interest to US military - you're right. Evaluation and testing of Starlink by US (and I'm sure, other friendly) military is by no means a secret. Army tests commercial satellite internet in pilot program is merely the most recent such mention that I quickly found in a web search. If you click on the link, you'll discover that this isn't a typical news article - it's an article from the ***US Army***.

For a tiny bit of light (or dark) humor on military use of Starlink, imagine a broadband satellite system for the US military, built by a US defense contractor, equivalent to Starlink2. Then the jamming and cyberattack situation arose. Imagine this conversation…

Pentagon: The broadband satellite communication system that you built for us is being jammed by the Russians, and it's impacting communications with our allies.

Defense Contractor: Well, this situation wasn't in the contract, so we'll need a follow-on contract and to scramble our resources fast, we'll need an *immediate* $10B.

Pentagon: Um, *$10B???* That will take time to arrange. But we and our allies *need this now!* We really need our broadband communications with them back up.

Defense Contractor: Well, that is serious! (pause) Tell you what, Pentagon… make it *$20B* and we promise to start right away and we'll try to deliver a fix… within 90 days.

…

Now, imagine the same conversation with SpaceX about Starlink…

Pentagon: Starlink is being jammed by the Russians, and it's impacting communications with our allies.

SpaceX: We're already on it. Hold our beer. (pause) OK, try it… *now!*

…

(To be crystal clear, the above "exchanges" are entirely imaginary.)

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Remarkable! Just… *remarkable*.

de Steve N8GNJ

Update 2022-03-21 - Washington Post and ARS Techica Articles

Washington Post / MSNBC: Elon Musk's Starlink is keeping Ukrainians online when traditional Internet fails.

The only notable mention I found in this article is that the claim that there are now more than five thousand Starlink user terminals in Ukraine, and "… new shipments [are] arriving every other day".

There's considerable dreck in this article.

ARS Technica: Starlink helps Ukraine's elite drone unit target and destroy Russian tanks

Article notes that Starlink user terminals are used to communicate between military units to coordinate drone strikes.

But I found this discussion to be more of the "Remarkable" aspect of SpaceX and Starlink:

> SpaceX President Gwynne Shotwell later said at a Caltech event that SpaceX "had been working on trying to get permission — landing rights—to lay down capacity in Ukraine... for a month and a half or so," according to SpaceNews.
>
> "The company, she said, had been waiting for a letter formally granting landing rights, but it never came before Russian forces invaded the country February 24," SpaceNews wrote. The Fedorov tweet served as permission, according to Shotwell. "They tweeted at Elon and so we turned it on," Shotwell said. "That was our permission. That was the letter from the minister. It was a tweet."

"… and so we turned it on…"

Remarkable!

Personal note - with Starlink doing so much to assist in Ukraine, I don't begrudge my turn in the Starlink queue to be deferred (I'm on the list with a deposit). I'd rather all available Starlink user terminals go to Ukraine. If I was offered the option, I'd even pay the cost for one to go to Ukraine.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out
Join the Fun on Amateur Radio for some pointers.

Closing the Channel

- In its mission to grow Amateur Radio and make it more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex!
- My ongoing Thanks to Tina Stroh KD7WSF for, well, *everything* and Bill Vodall W7NWP as *Zero Retries Instigator in Chief*.
- My ongoing Thanks to pseudostaffers Dan Romanchik KB6NU and Jeff Davis KE9V for continuing to spot, and write about "Zero Retries Interesting" type items, on their respective blogs, from Amateur Radio and beyond, that I don't spot on my own.
- Southgate Amateur Radio News consistently surfaces "Zero Retries Interesting" stories.
- The Substack email publishing platform makes Zero Retries possible. I recommend it for publishing

newsletters.

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All previous issues of Zero Retries are available without restriction (no paywalls). For some background, Zero Retries 0000 was the **Introduction Issue**. Zero Retries 0026 and Zero Retries 0027 were a **2021 Year End Review** of Zero Retries.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ (He / Him)
These bits were handcrafted in beautiful Bellingham, Washington, USA
2022-03-04, updated 2022-03-06

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Write something tweet-length (1-3 sentences) that encourages general discussion.

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The concept of an equivalent to Starlink is highly dubious at best. There simply isn't any credible competition (or equivalence) to Starlink, in reality, or conceptually. In my opinion, the Starlink (soon to be) mega-constellation, enabled by inexpensive and frequent launches from SpaceX, is an unassailable competitive advantage.